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September 13, 2013

Ms. Marlene Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Room TW-A325
Washington, D.C. 20554

Re: *Ex Parte Notice*

ET Docket No. 13-49

Dear Ms. Dortch:

On September 11, 2013, the undersigned and the individuals listed below, representing their companies and the Alliance of Automobile Manufacturers ("Alliance") and Association of Global Automakers ("Global"), met with Office of Engineering and Technology ("OET") staff to discuss issues raised in the above-referenced proceeding. The parties specifically addressed issues raised in the proceeding that affect the viability of Dedicated Short Range Communications ("DSRC") operations in the 5850-5925 MHz ("5.9 GHz") band. A copy of the presentation made to the OET staff is provided as an attachment to this notice.

OET staff participating in the meeting included:

Julius Knapp
Renee Gregory
Rashmi Doshi
Geraldine Matisse
Ira Keltz
Bryant Wellman
Navid Golshahi
Mark Settle
Karen Rackley
Aole Wilkins

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The Alliance and Global and other representatives attending the meeting included:

Mike Cammisa, Director, Safety, Global
Mark K. Dowd, Assistant General Counsel, Global
Tom Schaffnit, Advanced Safety Systems, Honda
Mike Shulman, Technical Leader, Ford Motor Company
Will Otero, Director, Transportation & Safety Policy, Alliance
John Kenney, Principal Researcher, Toyota
Ed Thomas, Hogan Lovells
Steve VanSickle, Project Manager, Crash Avoidance Metrics Partnership (CAMP)
Hariharan Krishnan, Technical Fellow, General Motors
Rich Lopez, Director, Federal Government Affairs, Alliance

Pursuant to Section 1.1206 of the Commission's rules, an electronic copy of this letter and the presentation made during the meeting is being filed for inclusion in the above-referenced docket.

Respectfully submitted,



Ari Fitzgerald
Counsel to the Alliance of Automobile Manufacturers and Association of Global Automakers

Attachment

cc: Julius Knapp
Renee Gregory
Rashmi Doshi
Geraldine Matise
Ira Keltz
Bryant Wellman
Navid Golshahi
Mark Settle
Karen Rackley
Aole Wilkins

5.9 GHz DSRC Connected Vehicles for Intelligent Transportation Systems

AUTO ALLIANCE

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GlobalAutomakers 

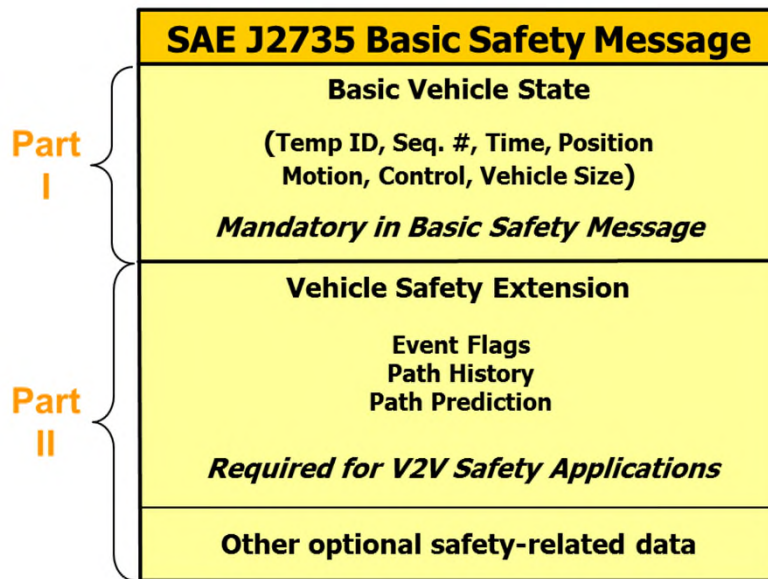
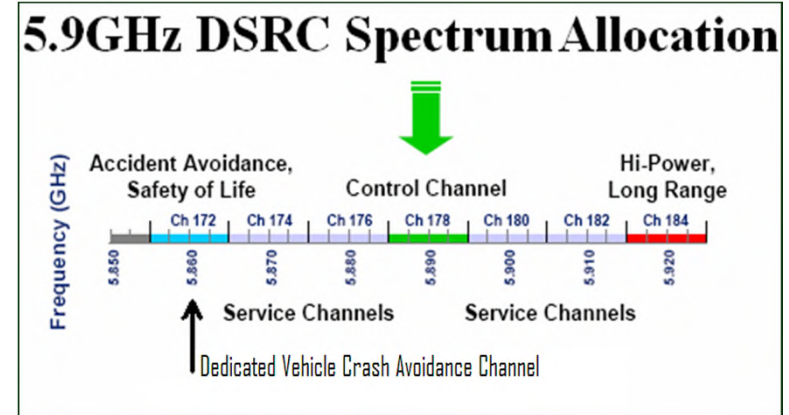
September 11, 2013

Introduction

- 5.9 GHz DSRC is essential for V2V crash-imminent safety applications, and must be protected from U-NII-3 and U-NII-4 devices.
- V2V safety has stringent communications requirements, but future pre-crash and automation requirements may be even more stringent.
- All current DSRC channels are needed for future applications and re-channelization and channel use rule changes are not feasible.
- Currently in final stages of U.S. DOT NHTSA mandate decision.
- Thorough testing is needed to determine whether sharing with U-NII devices is possible.

Dedicated Short Range Communications (DSRC)

- 75 MHz of spectrum @ 5.9 GHz for ITS
- Key Benefits
 - 802.11p technology similar to 802.11a
 - Low latency communication ($\ll 50$ ms)
 - High data transfer rates (3 – 27 Mbps)
 - Line-of-sight, up to 1000 m and 360°
 - Low power message reception (< -90 dBm)

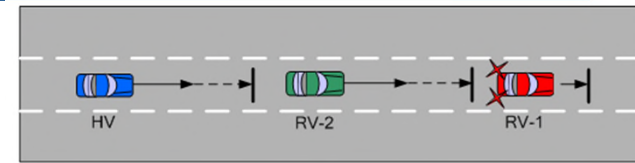


- Standards
 - IEEE: 802.11p, 1609.2 – 1609.4, 1609.12
 - SAE: J2735, J2945
- V2V Basic Safety Message (BSM)
 - Average message size: 320 bytes
 - PHY + MAC + WSMP: 80 bytes
 - Security including Certificate: 160 bytes
 - SAE J2735 BSM payload: 80 bytes
 - Default transmit rate: 10 Hz
 - More sophisticated protocols in development
 - Enables multiple V2V Safety Applications

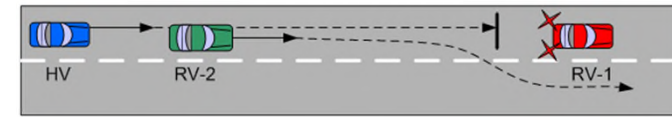
V2V Safety Communications – Summary



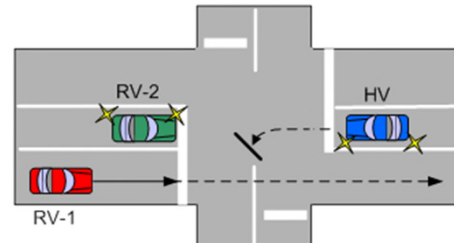
- Different manufacturers
- Communicating on the same channel
- Exchanging the same BSM information
- Enables multiple V2V safety applications



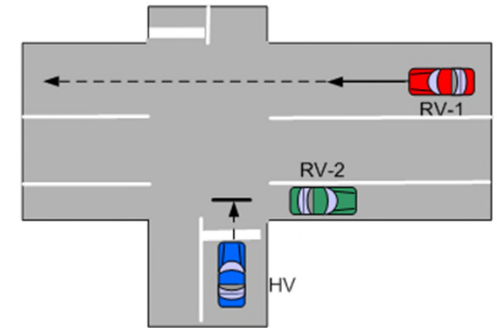
Emergency Electronic Brake Lights (EEBL)



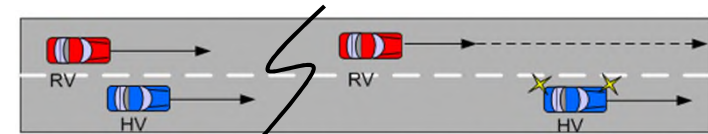
Forward Collision Warning (FCW)



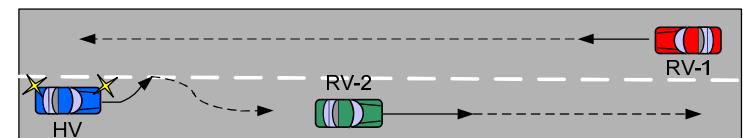
Left Turn Assist (LTA)



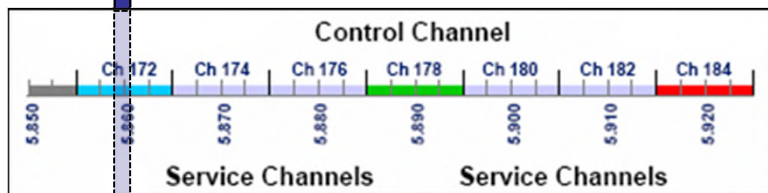
Intersection Movement Assist (IMA)



Blind Spot / Lane Change Warning (BSW / LCW)



Do Not Pass Warning (DNPW)



Illustrative DSRC Channel Plan

- Ch 172 -Vehicle-to-Vehicle: Crash Avoidance Safety *
- Ch 174 – Vehicle-to-Vehicle: Autonomous Vehicle and Pre-Crash
- Ch 176 - Vehicle-to-Infrastructure: RSU for Heavy Traffic and Multi-Lane Highway Automation
- Ch 178 - Central Control Channel *
- Ch 180 – Vehicle-to-Infrastructure: Security Communications (Anti-Hacking)
- Ch 182 - Vehicle-to-Infrastructure: Work Zone Safety, Tolling, Road Condition Warnings, Driver Assistance, Commercial Uses, etc.
- Ch 184 - Vehicle-to-Infrastructure: Public Safety Agencies, State Highway Agencies, etc. (Intersection Safety, Emergency Vehicle Signal Priority) *

*- Use restriction designated in FCC rules

The Commission Should Reject Qualcomm's Proposal for U-NII Use of the DSRC Band

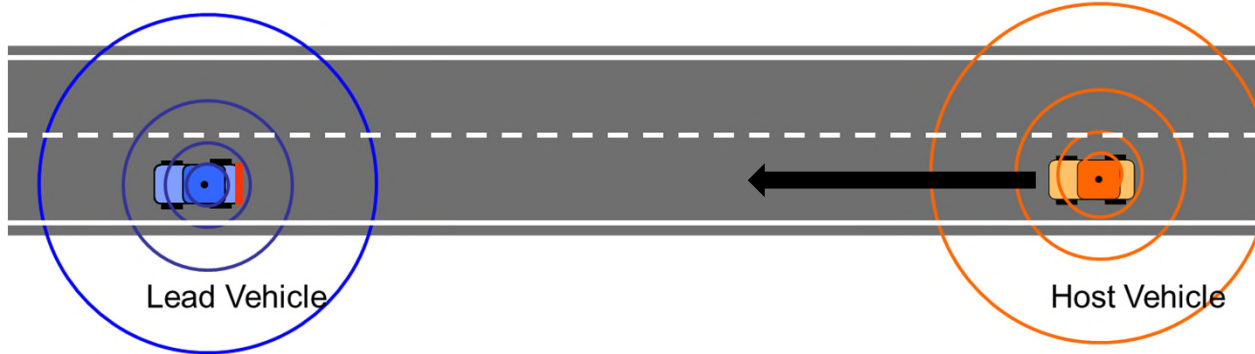
- The Qualcomm proposal puts DSRC Control Channel operations at risk of interference from U-NII devices.
- The Qualcomm proposal to increase DSRC channel size in the lower DSRC band from 10 MHz to 20 MHz ignores previous channel sounding studies.
- Altering DSRC channel usage requirements at this late stage could disrupt DSRC operations and plans, and require technical adjustments that complicate and delay DSRC roll-out.
- All DSRC channels are needed for V2V and V2I safety services and applications – fewer channels would significantly disrupt the effectiveness of the technology
- Relocating V2V operations to DSRC channels 182 and 184 would make V2V operations vulnerable to harmful interference from higher-powered public safety operations on DSRC channel 184 and high-powered, out-of-band satellite uplink operations.
- Implementation of the Qualcomm proposal (which would require changes in the DSRC rules) is beyond the scope of the 5 GHz proceeding.

Harmful Interference to 5.9 GHz DSRC Connected Vehicle Safety

- *"Harmful Interference" includes any "interference which endangers the functioning of" DSRC safety services, due to the fact that the opportunity for DSRC to potentially prevent a collision would be impaired. 47 C.F.R § 2.1*
- Interference should not lead to the delay or omission of a timely safety action (e.g., warning information or control actions provided to the driver/vehicle) that could have otherwise been provided in order to prevent a crash.
- The threat of an imminent crash could arise instantaneously during driving conflicts. Therefore, any delay in timely warning or control actions caused by interference must be imperceptible.

Harmful Interference to 5.9 GHz DSRC Connected Vehicle Safety – e.g. FCW

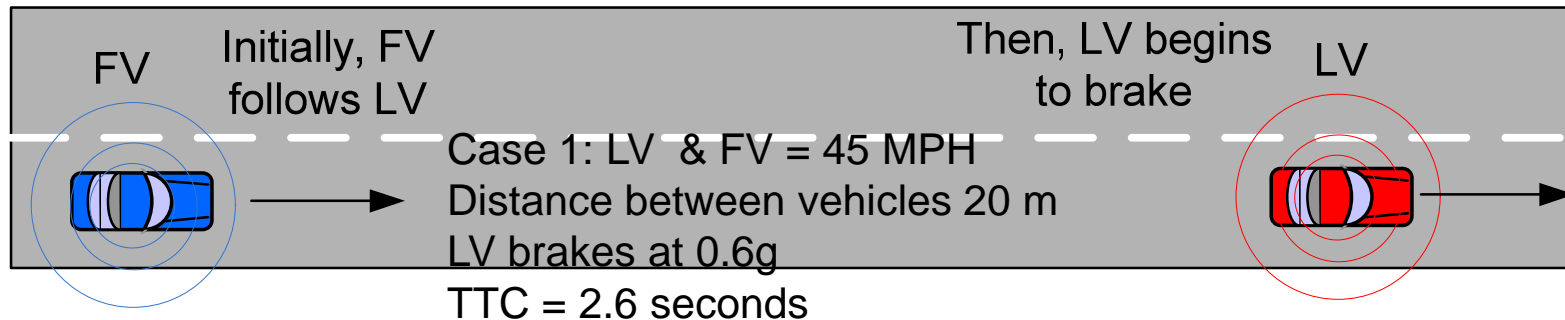
Forward Collision Warning (FCW)



- Cooperative FCW feature provides alerts intended to assist drivers in avoiding or mitigating a rear-end crash.
- FCW may alert the driver to an approaching (or closing) conflict a few seconds before the driver would have detected such a conflict (e.g., if the driver's eyes were off-the-road), so the driver can take any necessary corrective action (e.g., steering, hard braking, etc.).
- The goal of the alert timing approach is to allow the driver enough time to avoid the crash, and yet avoid annoying the driver with alerts perceived as occurring too early, too often or unnecessarily.

Harmful Interference to 5.9 GHz DSRC Connected Vehicle Safety – e.g. FCW-LVD

Forward Collision Warning (FCW) Lead Vehicle Decelerating (LVD) Scenario



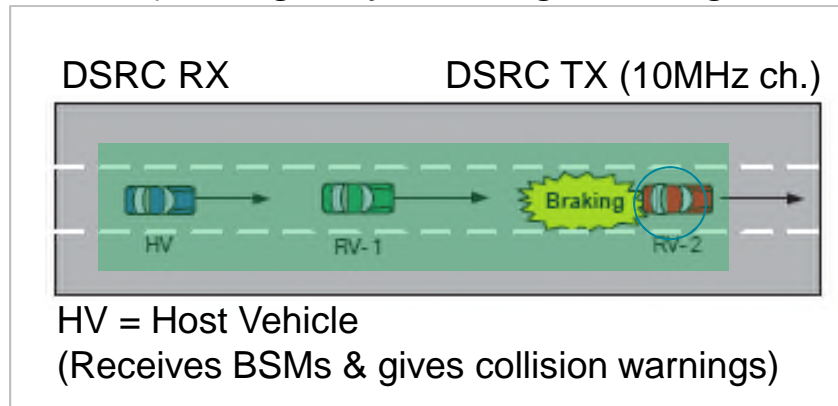
- Interference from U-NII devices could result in delay of timely warning information provided to the driver, or the warning could be completely missed. In either case, the opportunity for the driver to potentially prevent a crash is impaired.
- U-NII devices operating in the DSRC band could cause significant interference to packet (i.e. safety messages) reception, leading to unknown and perhaps high Inter-Packet Gap (IPG) and Packet Error Rate (PER).
- Consequently, they could cause harmful interference affecting the performance (and the benefits to be derived from) these safety systems.
- High IPG and PER would also affect security verification since the messages with certificates attached may be lost or delayed due to interference from U-NII devices.

Harmful Interference to 5.9 GHz DSRC Connected Vehicle Safety

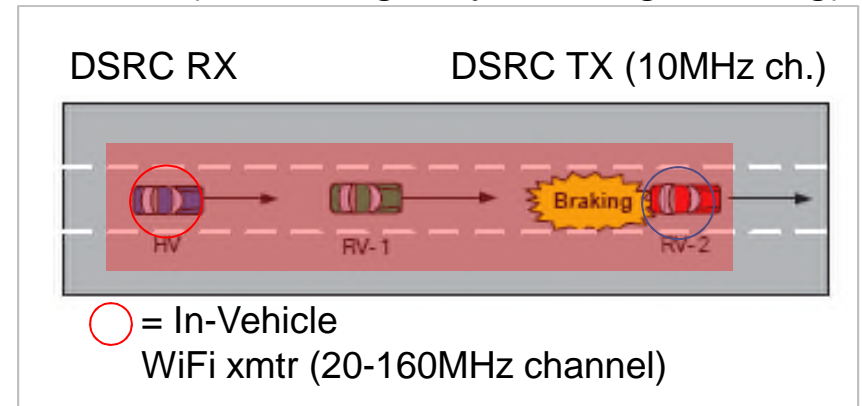
– DSRC Packet Loss in EEBL (Overlapping WiFi packets)

Emergency Electronic Brake Light (EEBL)

EEBL (Emergency Braking warning rec'd)



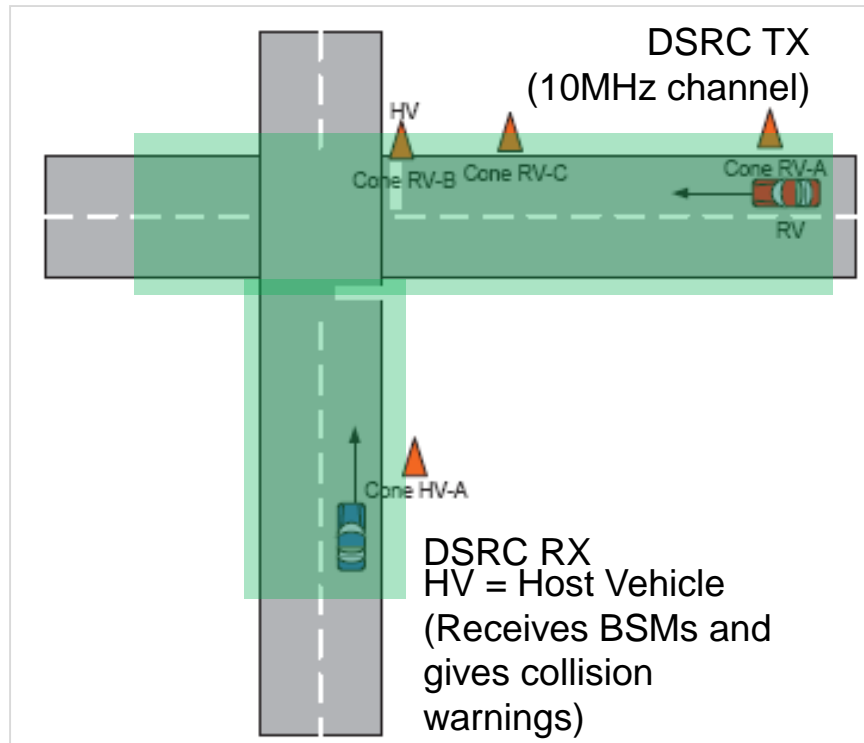
EEBL (no Emergency Braking warning)



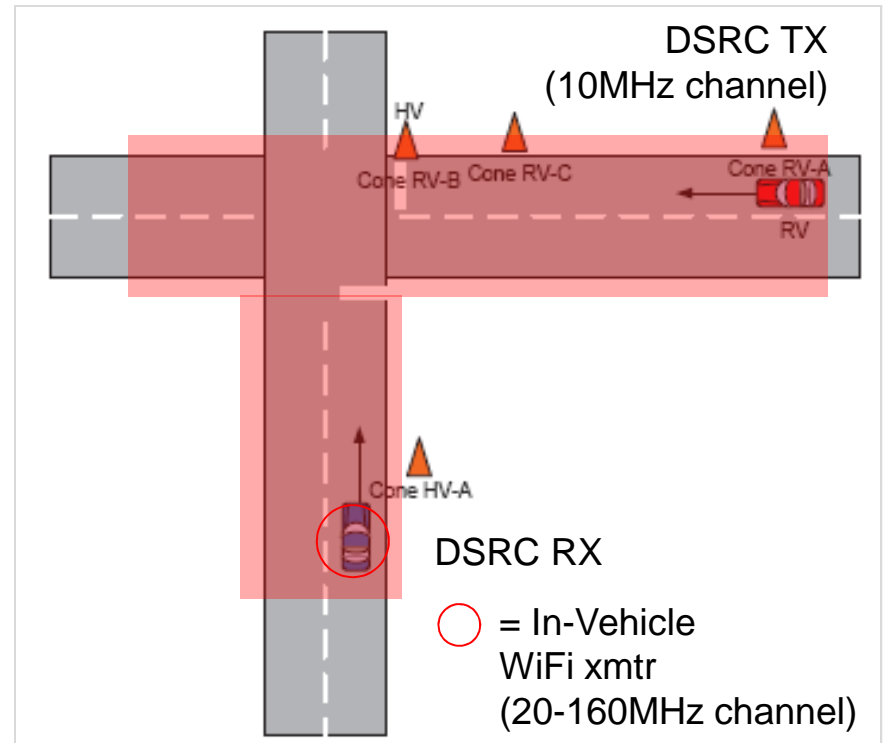
- The driver of the HV won't be warned of the hard braking event due to interference.
- The green area indicates low packet error between the BSM sender and the HV.
- The red area indicates regions with high packet loss due to overlapping WiFi packets.

Harmful Interference to 5.9 GHz DSRC Connected Vehicle Safety – DSRC Packet Loss in Cross-Path Collision (Overlapping WiFi)

Cross-Path Collision (driver gets warning)



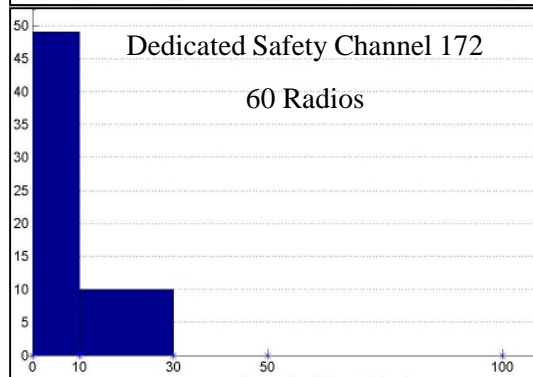
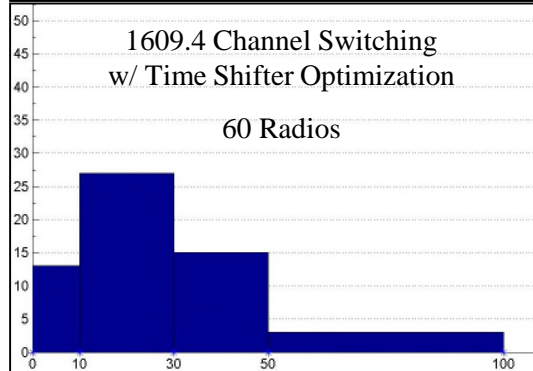
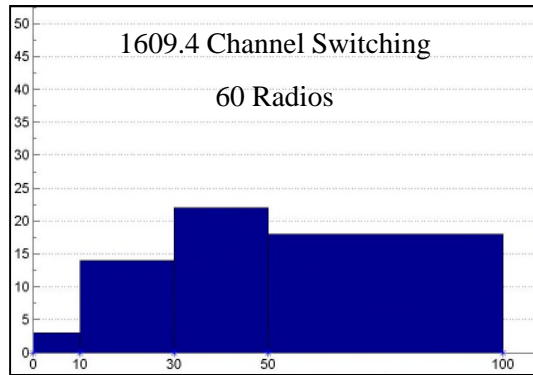
Cross-Path Collision (no driver warning)



- The driver of the HV will not receive the cross-path collision warning.
- The green area indicates low packet error between the BSM sender and the HV.
- The red area indicates regions with high packet loss due to overlapping WiFi packets.

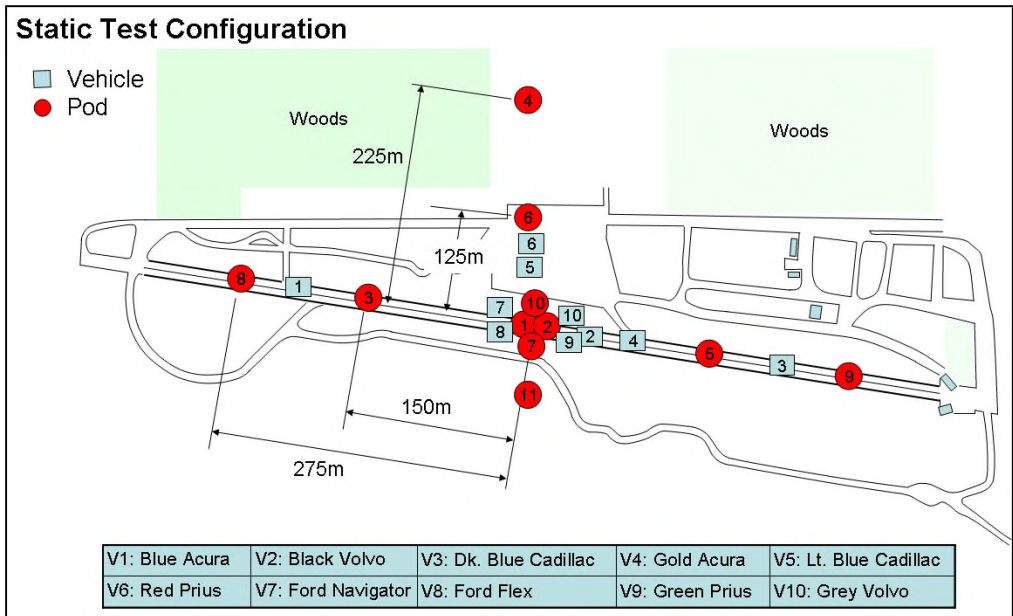
Early Multiple-OBE Congestion Testing (~2009)

Remote Vehicles: 0 – 50



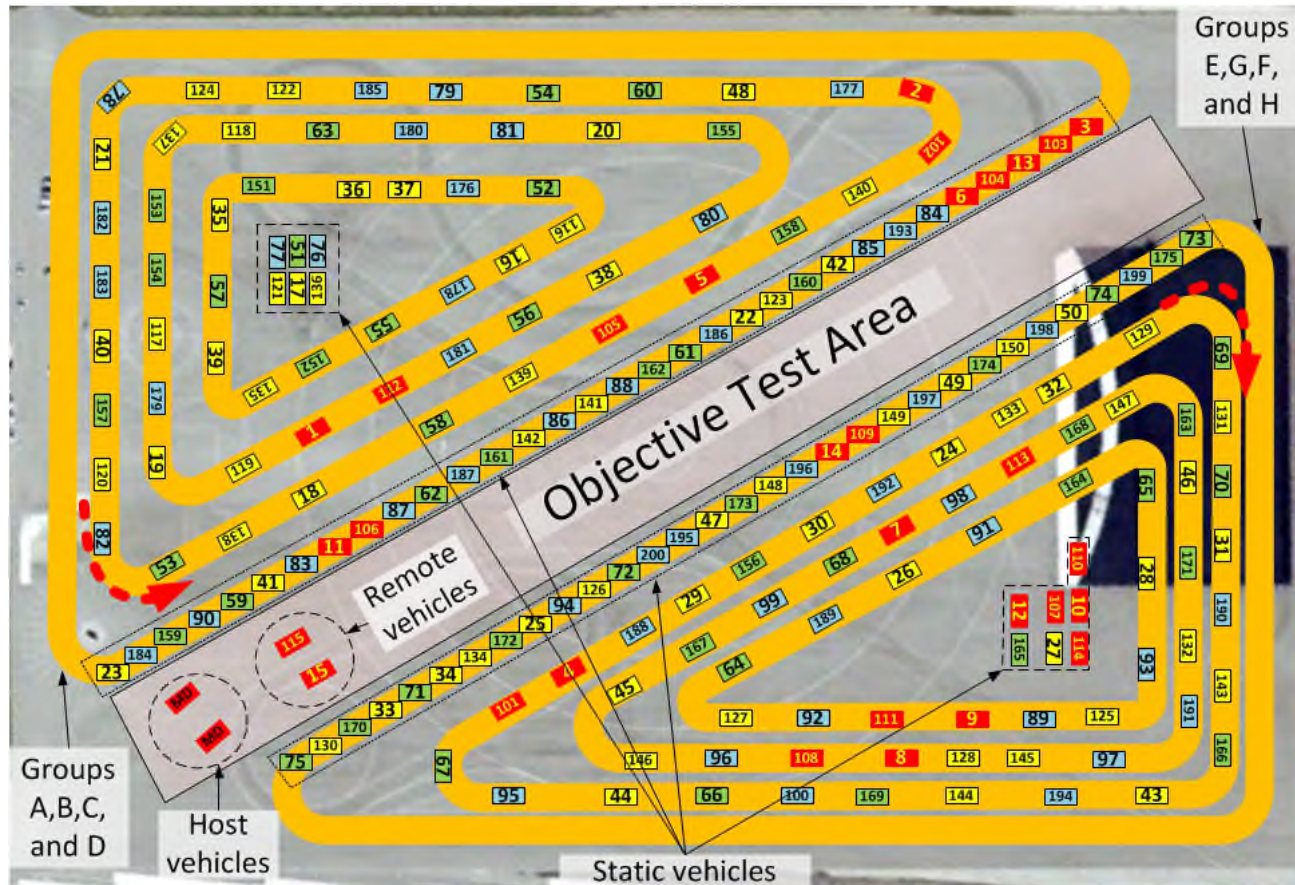
Cumulative % Packets Lost: 0 % – 100 %

- Static Vehicle Configuration
 - 60 OBEs
 - 10 Hz Message Tx Rate
 - 6 Mbps Data Tx Rate
 - 18-20 dBm Tx Power
- **Results indicate that dedicated full-time safety channel provides superior performance over IEEE 1609.4 channel switching**



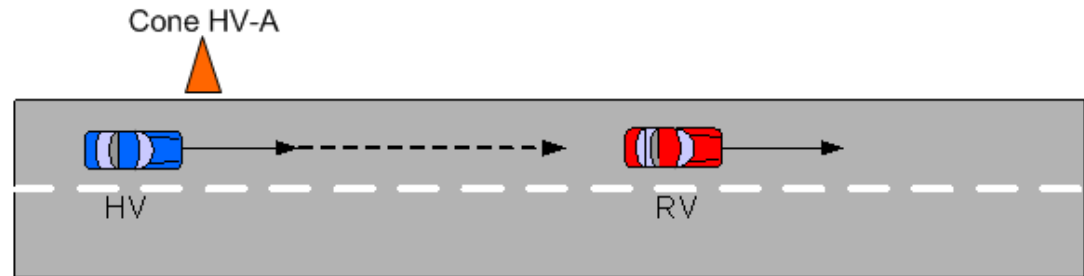
200 Vehicle Application Testing

- 200 physical vehicles
- Approximate 300 m x 450 m area
- Both moving and static vehicles
- Safety application scenarios performed between rows of vehicles



Forward Collision Warning – Slow Moving Vehicle

All of the warnings came within the acceptable bound of the nominal warning distance.



10 Hz Baseline

HV	RV	Run #	HV Speed	RV Speed	WRV%
1	015	1	22.99m/s	12m/s	1.5%
1	015	2	22.45m/s	11.72m/s	0%
2	115	1	22.70m/s	10.68m/s	-3.19%
2	115	2	21.91m/s	10.84m/s	2.37%

5 Hz Baseline

HV	RV	Run #	HV Speed	RV Speed	WRV%
1	015	1	22.78m/s	11.62m/s	-5.88%
1	015	2	22.69m/s	11.84m/s	-0.610%
2	115	1	21.47m/s	11.12m/s	0%
2	115	2	21.59m/s	10.52m/s	-0.59%

Alg-X

HV	RV	Run #	HV Speed	RV Speed	WRV%
1	015	1	22.73m/s	12.26m/s	-1%
1	015	2	21.21m/s	11.5m/s	2.44%
2	115	1	21.98m/s	10.58m/s	2.59%
2	115	2	22.35m/s	9.94m/s	0.78%

Alg-Y

HV	RV	Run #	HV Speed	RV Speed	WRV%
1	015	1	22.57m/s	10.86m/s	-1.65%
1	015	2	22.41m/s	11.62m/s	1.24%
2	115	1	21.64m/s	10.18m/s	-1.7%
2	115	2	22.00m/s	11.02m/s	0%

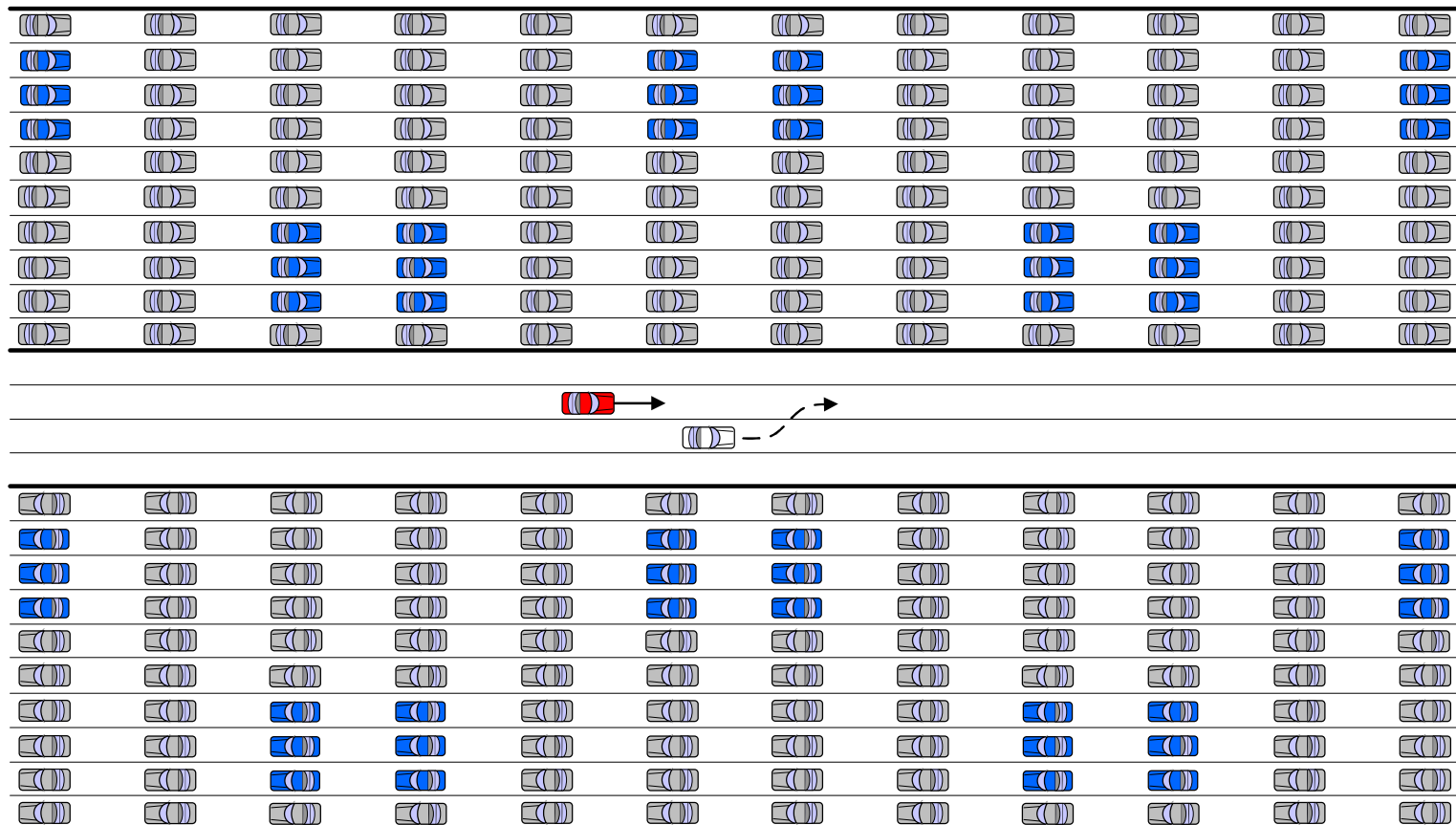
$$\text{WRV}\% = ((\text{NominalRange} - \text{ActualRange}) / \text{NominalRange}) * 100$$

200 Vehicle Application Testing Conclusion

- With congestion from 200 vehicles, V2V safety application scenario warnings were provided within the nominal warning range for all transmit protocols

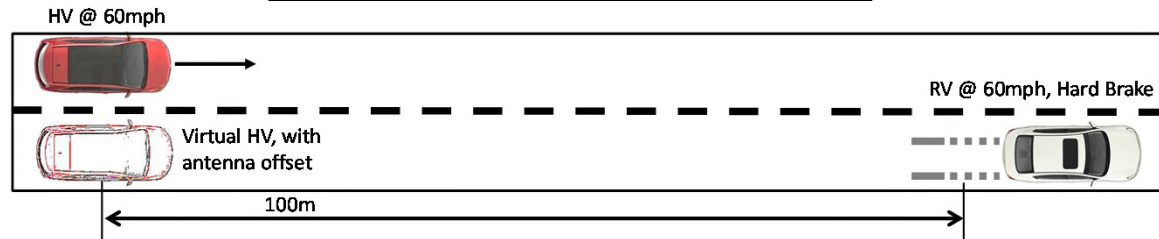
Application Scenarios in an Emulation

- Emulated 960 vehicles in 525 m area emulates 20 lanes of bumper-to-bumper traffic
- Safety application scenarios performed between rows of carts

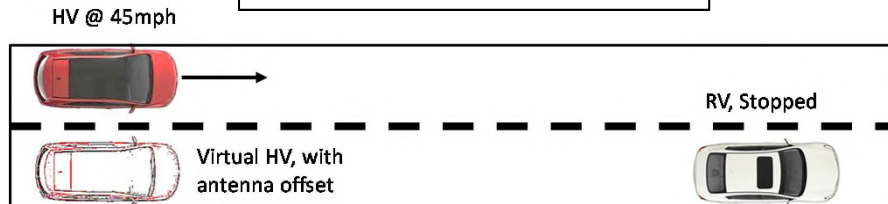


Scenarios Executed

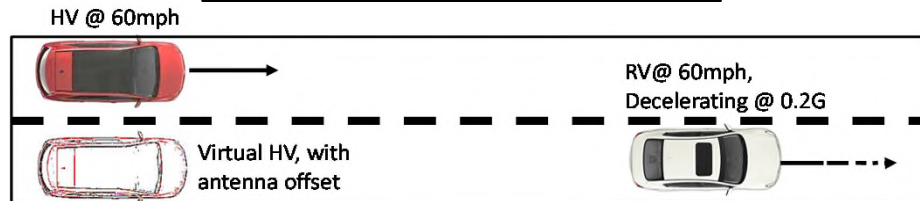
EEBL – Hard Braking RV



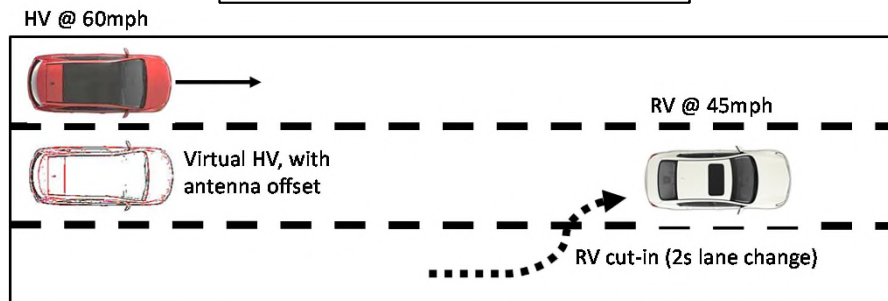
FCW – Stopped RV



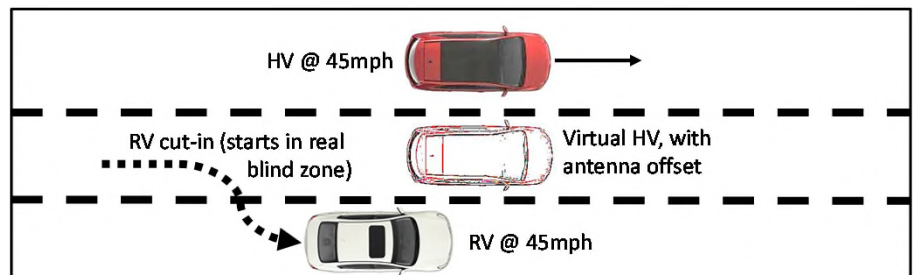
FCW – Decelerating RV



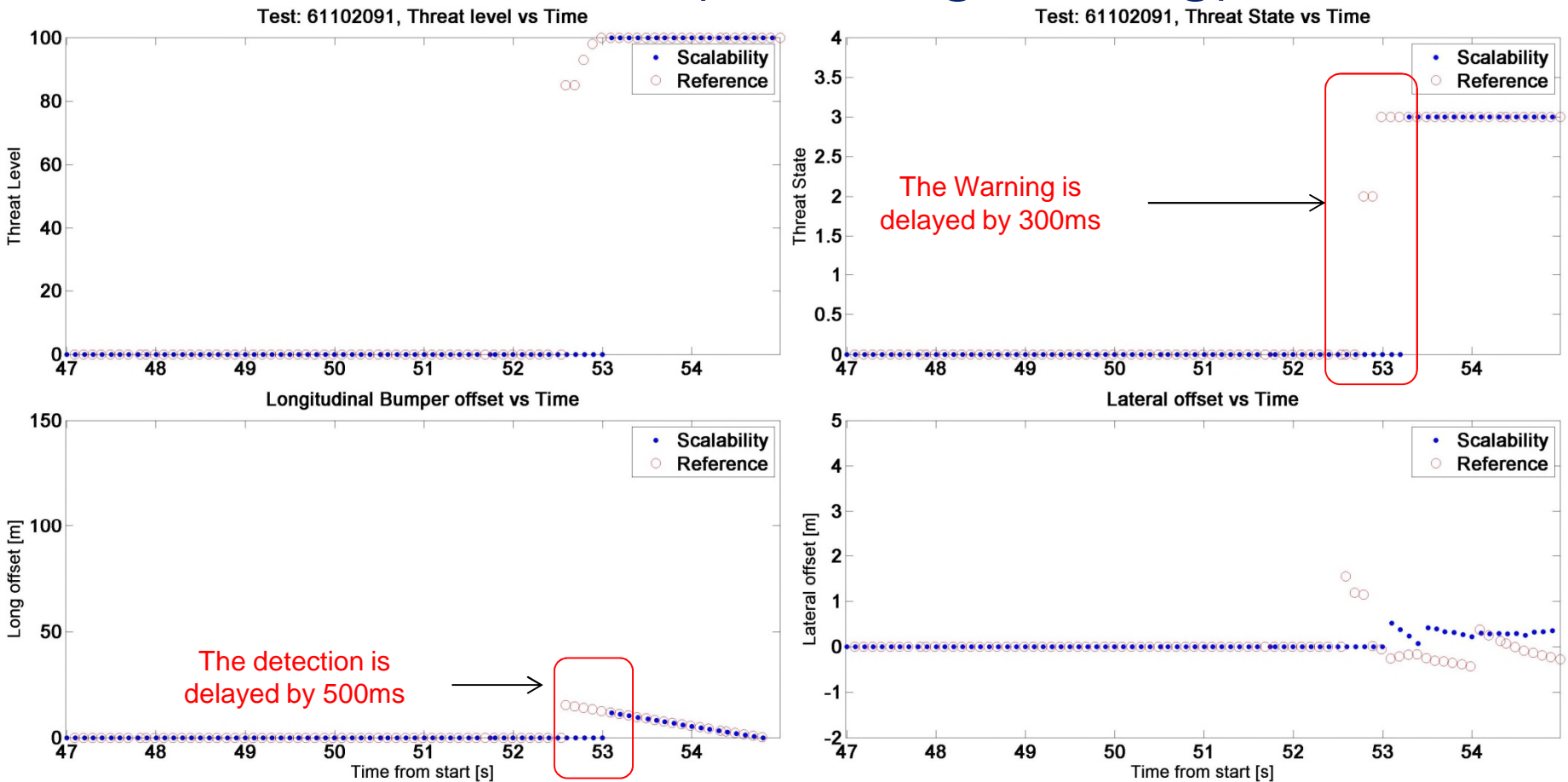
FCW – Cut-in RV



BSW – Cut-in RV

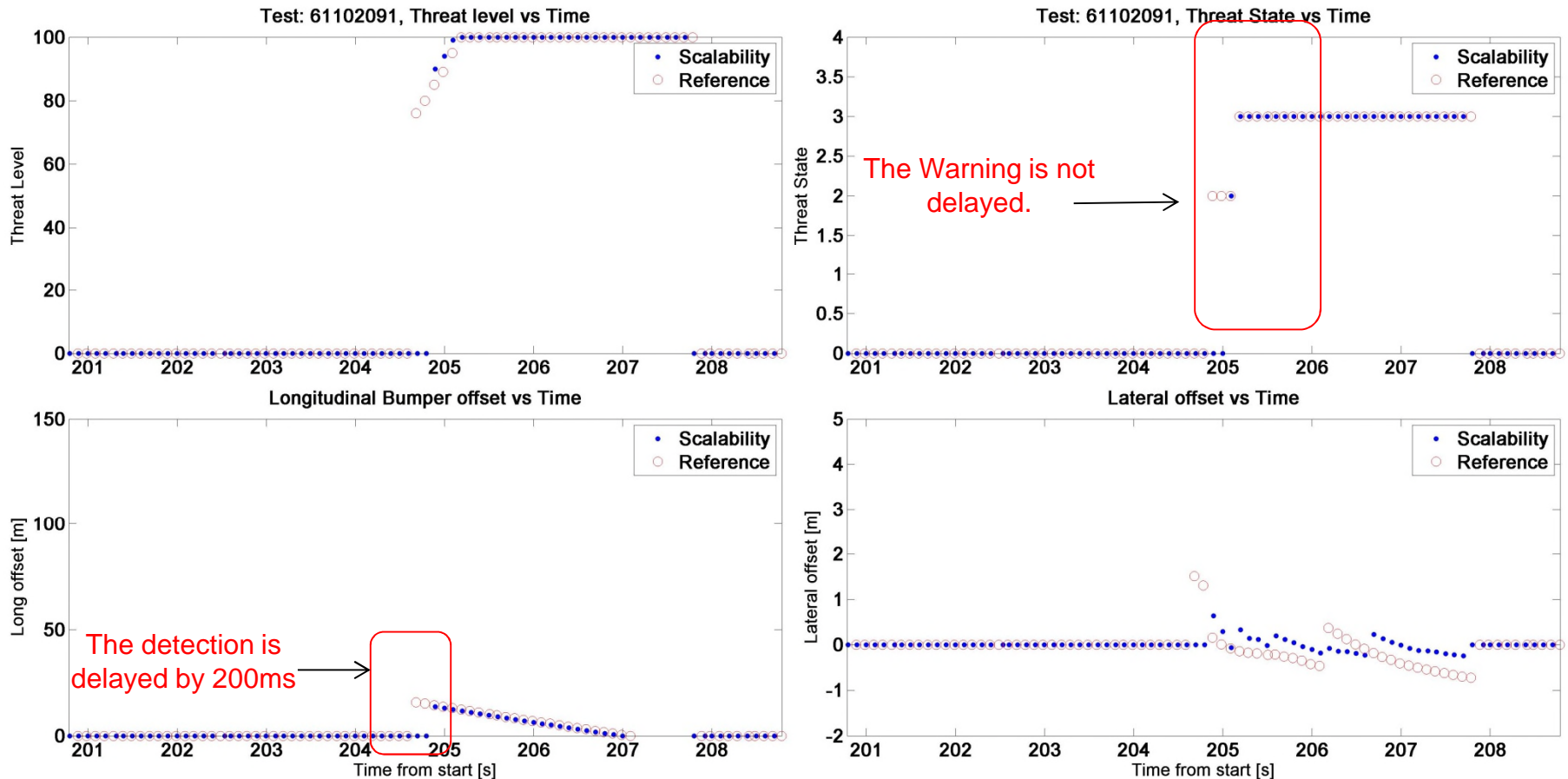


FCW Cut-in Run 1 - Baseline 1000 OBE Emulation (Warning Timing)



- The Warning alert is delayed by 300 ms.
- Also, when compared to the Reference, the lane change detection and hence the correct classification as in-lane is delayed by approximately 500 ms.

FCW Cut-in Run 2 - Baseline 1000 OBE Emulation (Warning Timing)



- When compared to the Reference, the lane change detection and hence the correct classification as in-lane is delayed by approximately 200 ms.

Emulation Summary and Next Steps

- 1000 OBE emulation results show that application warnings are not significantly delayed, however:
 - Results are preliminary
 - Emulation approach needs to be confirmed
 - Greater than 1000 vehicles will need to be supported
 - Congestion control protocols to support V2V safety, which are in testing, likely to offer better performance
- Next Congested Environment Testing Steps
 - Execute a 400 OBE field test
 - Confirm emulation approach with field test results
 - Incorporate field test results into simulation calibration activities
 - Run simulations for larger numbers of OBEs

V2X Safety and Automation Applications Must Be Free From Harmful Interference

- OEMs and NHTSA have focused on V2V Crash-Imminent Warnings. In the Model Deployment, Basic Safety Messages are on one DSRC channel, service announcements on another channel, and services on several others. NHTSA's 2013 regulatory decision will address the subject.
- Additional applications which require low-latency communications will use other DSRC channels.
- For example, NHTSA recent guidance on automated vehicles states:
 - Automated vehicles may use on-board sensors, cameras, GPS, and telecommunications to obtain information in order to make their own judgments regarding safety-critical situations and act appropriately by effectuating control at some level. In fact, the realization of the full potential benefits and broad-scale implementation of the highest level of automation may conceivably rely on V2V technology as an important input to ensure that the vehicle has full awareness of its surroundings.

Summary

- 5.9 GHz DSRC is essential for V2V crash-imminent safety applications, and must be protected from U-NII-3 and U-NII-4 devices.
- V2V safety has stringent communications requirements, but future pre-crash and automation requirements may be even more stringent.
- All current DSRC channels are needed for future applications and re-channelization and channel use rule changes are not feasible.
- Currently in final stages of U.S. DOT NHTSA mandate decision.
- Thorough testing is needed to determine U-NII device sharing constraints and appropriate requirements.